**UNIVERSIDADE TÉCNICA DE LISBOA**

INSTITUTO SUPERIOR DE ECONOMIA E GESTÃO


**Master in Finance**

# Competitive Advantages as Source of Excess Stock Returns


Work by Nelson Miguel Jacinto Alves

Project with the supervision of MsC. Pedro Rino Vieira


**Examiners:** Professor Raquel M. Gaspar

MsC. Pedro Rino Vieira

MsC. Inês Fonseca Pinto


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# Resumo

A avaliação das perspectivas para uma determinada empresa é um passo critico no processo de valorização de uma acção. Uma correcta avaliação resulta na definição de um conjunto de pressupostos que levarão a uma avaliação mais precisa. Analises erradas levam a conclusões erradas e são resultado da falta de um quadro orientador que direccione o estudo das perspectivas das empresas em causa. Para resolver este problema decidimos recorrer à teoria da gestão estratégica e testar a relação entre rendibilidades de acções e Vantagens Competitivas relevantes em determinada indústria. Aplicámos este método à Industria Siderúrgica e realizamos testes estatísticos. Os resultados mostram-nos que, na generalidade, melhorias na eficiência operacional, medida através das primeiras diferenças da *margem bruta*, oferece retornos acima da taxa de retorno sem risco. Estes resultados mostram-nos que a selecção de portfolios, utilizando Vantagens Competitivas, permitem-nos obter retornos acima da média.

Palavras-chave: Valorização; Gestão Estratégica; Industria Siderúrgica; Margem Bruta; Vantagens Competitivas, CAPM, Teoria da Carteira, Cross Section Rrturns

# Abstract

The perspectives assessment of any given company is a vital step to the efficiency of the valuation process. A correct assessment will result in the definition of assumptions that will lead to better valuation results. Wrong conclusions are frequently taken because a bad assessment was made and this is the result of the lack of a proper framework that guides the analysis of company perspectives. To solve this problem we decided to use strategic management theory and test the relation between stock returns and competitive advantages relevant for a given industry. We applied this method to the Steel Industry and tested it statistically. The results showed us that, generally, improvements in the operational efficiency, measured by the first differences in *gross margin*, provide excess returns. This results show us that the use of Competitive Advantages to select portfolios, in the Steel Industry, yields better than average returns.



Key words: Valuation; Strategic Management; Steel Industry; Gross Margin; Competitive Advantages, CAPM, Portfolio Theory, Cross Section Returns

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# 1 - Introduction

In the genesis of this work is the desire to offer a new and complementary perspective to the security analysis framework.

Today, in the financial markets, stock analysts usually look for "fundamentals" and then try to assess potential growth. An asset manager might add, to this assessment, parts of the portfolio theory. We can divide the stock selection process in three parts: valuation, perspectives assessment and portfolio construction (Chugh and Meador, 1984). The weakest part in the mentioned process is the perspective assessment, mainly because, to our best knowledge, there is not any coherent framework for securities analysis of firm's growth potential (Cottle, Murray and Block, 1988). Our goal with this work is to make some progress in the right direction trough the development of an integrated initial framework that is in accordance with both valuation theory, portfolio theory and strategic management. In this work we will define relevant Competitive Advantages (CAs) for the Steel Industry and perform an analysis of its impact on stock returns. We should state the reasons that led to the choice of the Steel Industry as base case for our study. The Steel Industry has a long history, this means that many sources of information already exist. Also many studies were made about this industry and its conclusions are usually extremely similar in relation to the CAs present in this work. This will help us avoid controversy related with the choice of the CAs. Other advantage is the fact that exists a long database of companies in this industry with crucial information, which will allow us to make the work credible from the statistical perspective.

In the Strategic Management literature, Competitive Advantages are related with above average profits, which in accordance with valuation theory should mean above average investment returns (Porter, 1985). Our results suggest that there is a positive relation between Competitive Advantages and stock returns. For example we found that during the period of the study Low Costs Achieved are source of excess returns. We also tested for the period before the crisis and during the crisis. The results are very interesting.

We will start by constructing a survey of the literature in stock returns. In section 2 we will review cross section returns, and the most prominent models used and studied. We will look for tools that allow us to measure excess stock returns, and its relation with Competitive

Advantages. The theoretical background related with competitive advantages will be explored in section 3. Our focus will be on Competitive Advantages applicable to our case. Following this, we will construct a model based in the theoretical foundations built in sections 2 and 3. This will consist in the model, in section 4, designed to capture the effects of Competitive Advantages and also to control for known drivers of stock returns. In section 5, we will show and explain the results obtained. In section 6 we will comment on the main limitations and problems involved in the making of this work. We will finish in section 7, with our conclusions and insights for future research.

# 2 - Cross-Section Returns

### *2.1 - Historical Context*

The middle of the 20$^{th}$ century brought new theories to the fields of investments, portfolio selection and diversification. Markowitz (1952, 1959) is one of the examples of academics with new findings in this areas.

However in the beginning of the 60's there was still a lack of a microeconomic theory dealing with conditions of risk (Sharpe, 1964). At the time academics theorized about the idea that, if rational, one investor should be able to reach any point in the capital market line. This way he can only obtain a higher return if he incurs in additional risk. Therefore, the price of the investment can be divided in two parts: the price of time and the price of risk (the expected additional return per unit of return of risk incurred).

Markowitz (1952, 1959) stated that an investor should consider portfolio return as a desirable thing, and return variance as an undesirable thing. Following this logic he concludes that an investor should pursue a set of efficient portfolios that maximize returns for a given variance.

This way, under certain conditions, it should be possible for an investor to setup an optimum portfolio of risky assets and then allocate his funds between this risky portfolio and risk-free assets. Therefore, the investor is capable of defining the level of risk with which he is comfortable (Tobin, 1958).

Although the majority of the authors at this point used the mean-variance approach, this did not result in the construction of a market equilibrium theory of asset prices under conditions of risk (Sharpe, 1964).

Sharpe (1964) concluded that there is a relationship between expected returns and systematic risk. This author stated that the return on a given asset *i*, included in an optimal portfolio *g*, will be heavily related with the return on the portfolio *g*, Sharpe called this systematic risk. The specification of a relation between the returns of *i* and *g* allows the utilization of a predictive model.

The usual proceeding is to perform the regression of the returns of any given security against its benchmark. Sharpe (1964), Lintner (1965) and Black(1972) introduced the asset pricing model based on the assumption that expected returns on a security are sensitive to the market return, commonly known as market $\beta$. In other words, expected returns are a positive linear function of the slope of the security's returns on the market's return regression, and the $\beta$'s are enough to provide a description of the cross-section of average returns (Fama and French, 1992). The central idea was that the market portfolio is mean-variance efficient in the way Markowitz (1959) described it.

The model was commonly known as the Sharpe-Lintner-Black (static) Capital Asset Pricing Model (CAPM), and was defined as:

$$E[R_i] = \gamma_0 + \gamma_1\beta_1,$$

Where:

$E[R_i]$ is defined as the expected on any asset *i*,

$\gamma_0, \gamma_1$ are the coefficients of the regression,

$\beta_1$ is defined as

$$\beta_1 = Cov(R_i, R_m) / Var[R_m],$$

Where:

$Cov(R_i, R_m)$ is the covariance between $R_i, R_m$,

$Var[R_m]$ is the variance of $R_m$,

Fama and French (1992) conducted a series of tests on the market $\beta$ where they concluded that for prolonged periods of time market $\beta$ does not help explain expected returns. Banz

(1981) examined the relation between returns and size (total market value) of a group of stocks, and concluded that smaller firms had more risk, on average, than larger firms. Basu (1983) tested the effect of firm size and earnings to price ratio (earnings' yield) with stock returns. His results confirm that stocks with high *E/P* ratio earn, on average, higher risk adjusted returns. This effect is not independent of firm size. Bhandari (1988) concluded that the expected stock returns positively related with financial leverage when controlling for market $\beta$ and firm size. As shown by these authors numerous factors not included in the capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1965) and Black (1972) are relevant in explaining stock returns. These patterns are called anomalies.

This way, Fama and French (1992) concluded that if the market is rational then stock risks are multidimensional, and might be proxied by this different dimensions. The study of these anomalies resulted in Fama and French (1993) multifactor model

### *2.2 - Fama-French Multifactor Model*

The FF (1993) multifactor model captures most of this effects. Fama-French multifactor model states that the expected return on a portfolio in excess of the risk-free rate is explained by the sensitivity of the return to three factors: the market return, the size of the company, and the book-to-market ratio of the company. The conceptual model is the following:

$$E(R_i) - R_f = b_i[E(R_m) - R_f] + s_i E(SMB) + h_i E(HML),$$

Where:

$E(R_i) - R_f$ is the expected return on a portfolio in excess of the risk-free rate;

$E(R_m) - R_f$ is the expected excess return on a broad market portfolio;

$E(SMB)$ is the expected difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (*SMB*, small minus big).

$E(HML)$ is the expected difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (*HML*, high minus low).

$b_i, s_i, h_i$ are the effects of the correspondent variable in the $E(R_i) - R_f$ ;

Fama-French (1995), found that the book equity to market equity ratio (*BE/ME*) captured a significant part of the cross-section of average returns. The authors theorized that systematic differences in returns are caused by differences in risk. Therefore, if stocks are priced rationally, then size (Market Equity) and *BE/ME* can be a good proxy for sensitivity to common risk factors in returns. Fama-French (1995), demonstrated that portfolios constructed to capture risk factors related to *ME* and *BE/ME* explain a significant amount of the variation in stock returns.

In the same article, the authors provide an economic theory to justify the above relation. The main idea is that low *BE/ME* is a characteristic of firms with high average return on capital, and high *BE/ME* is typical of distressed firms, therefore investors will demand higher expected returns from distressed firms because of the extra risk. At the same time, after controlling for *BE/ME*, size tends to be positively correlated with earnings on book equity, although this last relation was not significant until 1980.

Summarizing, Fama-French multifactor model explains the cross-section variation in expected returns, because pricing rationality implies that differences in average returns are related to differences in risk, then ME and BE/ME must proxy for sensitivity to common risk factors in returns.

### *2.3 - Fama-French Multifactor Model Criticism*

After Fama and French published their set of articles sustaining the multifactor model some criticism arose.

Lakonishok, Shleifer, and Vishny (1994) defended that the high returns originated in high book-to-market stocks (value stocks) are the result of an incorrect pricing by investors that presume that past earnings growth rates of low book-to-market stocks (growth stocks) will continue in the future. What happens is an over discount of future earnings of growth stocks, and an under discount of value stocks that later will produce high returns on the latter. Other explanation offered by Lakonishok, Shleifer, and Vishny (1994) is that growth stocks are more attractive to less experienced investors who drive the prices higher, therefore lowering the expected returns of the stocks.

Daniel and Titman (1997), argued that the prevailing literature focused on the debate whether the factors could be an economic representation of relevant aggregated risk. However the authors question the possibility of *ME/BE* and *ME* are associated with risk factors, and if there is any risk premium related to these factors. They concluded that: "(1) there is no discernible separate risk factor associated with high or low book-to-market (characteristic) firms, and (2) there is no return premium associated with any of the three factors identified by Fama and French (1993)." Daniel and Titman (1997, p. 3). The results obtained suggest that the high returns originated cannot be interpreted as compensation for risk factor. The main reason to the existence of significant covariance between high book-to market stocks is not the presence of particular risks associated with distress, but the fact that this stocks usually have similar properties. The characteristics might be related lines of business, same industry or geographical region.

Therefore in the development of this work we will use Daniel and Titman (1997) assumption that the factors in the Fama-French multifactor model are in fact proxies for firm characteristics, and not risk factors. This way we will be able to avoid the criticism mentioned and we will be testing firms characteristics that might affect returns. Since we are looking for characteristics that provide above average returns and firm characteristics are the bundle of resources and capabilities that exist within a company, we are in fact testing for interactions that can provide competitive advantage.

# 3 - Competitive Advantages in the Steel Industry

### *3.1 – Historical Context*

In the first decades of the last century, economists have focused in the conceptualization of a framework for the treatment of the financial markets. Two main views were prevalent, one sustained that the long-term estimation of investment value is on average fruitless because the people practicing it do not have enough weight on the market (Keynes, 1935). Other view sustained that if you calculated correctly the intrinsic value of any investment, and if you buy it at a price below its intrinsic value, then you would never lose money (Williams, 1938).
Keynes (1935, p. 130) argued that "(…) professional investment may be likened to those newspaper competitions in which the competitors have to pick out of six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly

corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds the prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not a case of choosing those which to the best of one's judgment, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe who practice the fourth, fifth and higher degrees."

The author argues that it might prove better for an investor to follow the crowd than to enter laborious work trying to forecast investment value and to expect that the future proves him right.

John Burr Williams (1938) argued that the present worth of cash-flows is the critical factor in buying stocks. If an investor buys a security below its investment value, he will never lose even if the price falls at once, because he can always hold for income and get an above normal return on his price cost. Williams (1938) developed the mathematical foundations for investment analysis. However, the greatest problem on his theory, is that it is heavily dependent on the assumptions for certain variables, which is the real risk in his model: the risk of having wrong assumptions.

Fisher (1958) would use much less calculations on his valuations, putting the emphasis on getting the assumptions right. He would look for a set of characteristics, in a company, that would reduce the uncertain about the assumptions set, usually growth prospects, and profitability. Fisher (1958) advised looking for firms with low-cost production; strong marketing organization; outstanding research and technical effort; financial skills; flexible, motivated and creative human resources; and always check for the industry characteristics.

Porter (1985) brought to the public the concept of sustainable Competitive Advantage (hereafter CA). The characteristics mentioned in the last paragraph can easily be classified as drivers of CA as they are defined by Porter (1985). To the same effect Porter (1985) also stated that the presence of competitive advantage was a source of above average returns.

This way, returning to Williams (1938), one can argue that if the presence of competitive advantages will result in higher cash-flows with less uncertainty, the assumptions defined by Williams' model will be more robust, and at the same time the investment return calculated should be above average. The real question is: does the market discount this fact?

This work intends to provide further insights to this discussion, and to identify potential tools that allow to test the theory developed trough this work.
In the following sections we carefully select a set of Competitive Advantages (CA) that we consider that can be used in the study of the Steel Industry.

### *3.2 - Competitive Advantages Definition*

Before we progress in our work we should remark that CA is a critical concept in strategic management. However there is not one widely accepted definition, instead there are many definitions. In the context of our work, we think that the following three definitions are the most relevant:

i) Competitive Advantage "is a factor or an effect which permits one participant in a business to offer a product or service more effectively than competitors." Carroll (1982, p. 10).

ii) "Competitive advantage grows fundamentally out of the value a firm is able to create for its buyers that exceeds the firm's cost of creating it." Porter (1985, p.3).

iii) Competitive Advantage "is the unique position an organization develops vis-à-vis its competitors through its patterns of resource deployments." Hofer and Schendel (1978, p.25).

Porter (1985) defines two main alternatives strategies to achieve success: cost leadership or differentiation. This way every driver of competitive advantage must be a positive influence for one of these two types of strategies.
Veríssimo (2004) defined a set of competitive advantage drivers. We decided to choose the CAs from that set for our research, with some modifications that better suite our specific work. The set of drivers adopted was chosen in accordance with the management theory on the Steel Industry.

### *3.3 – The Steel Industry and its Competitive Advantages*

The steel industry is characterized by its capital intensive nature. Therefore fixed costs perform an important role in the management of this units. Usually mills try to operate close to full capacity in order to dilute their fixed costs. Thompson and Strickland (1992), argued that cost efficiency is a critical factor to achieve success, mainly because the majority of steel products are in fact commodities, therefore the price is the main decision factor for buyers. There are two CAs associated with productive efficiency in the set designed by Veríssimo (2004): Economies of Scale and Low Costs Achieved.

Thompson and Strickland (1992) also emphasized that constant improvements are determinant to the success of steel mills, mainly because these improvements result in increased output, faster operations, higher quality, and lower costs. Usually cost-saving and efficiency enhancements are executed trough capital expenditures (Capex) which are used to implement cutting edge technology. This indicates that innovation is very important to the steel industry. In the same work Thompson mentions interviews with Steel executives where it is mentioned the fact that the Steel Industry is extremely dependent of economic cycles, which force them to be prepared for bad times through the maintenance of good financial strength in order to maintain the ability to invest even in bad times.

Following Thompson's analysis of the Steel Industry, we think that we should test for: Low Cost Achieved, Economies of Scale, Innovation, and Financial Strength and Financial Skills. Additionally we will control for Market Risk ($\beta$), Size and *BE/ME* ratio, as Fama-French suggested, but in the perspective used by Daniel and Titman (1997), as we stated before.

### *3.4 - Selected Drivers of Competitive Advantages*

For the case studied in this work we decided to select the following drivers of CA from the set provided by Veríssimo (2004). Our choice is justified by the applicability of these CA to the case in study, as addressed before.

#### 3.4.1 - Economies of Scale

In general terms, we can say that economies of scale exist when fixed costs are much higher than variable costs, in the predominant business model of a given industry. So large companies are able to amortize the fixed costs over greater volumes, condemning small competitors to play the game on a adversely sloped field (Christensen, 2001).

Porter (1985) observed that cost advantage will result in above average performance only if a firm can sustain it in order to create a key entry/mobility barrier. A firm can do that by increasing advertising spending, increase spending to boost the rate of technological change, shorter model life cycles where models require fixed or quasi-fixed development costs, increase sales force or service coverage. Since large scale is the factor that allows an activity to be performed in an unique way that is not possible at a smaller volume, competitors will have huge costs to replicate the strategy, mainly because he will have to buy market share. In order to test these driver of CA we will use Total Sales as a proxy for Economies of Scale. Total Sales has been used as proxy to capture economies of scale by many authors such as Rugman and Verbeke (2007).

Assumption 1: *Economies of Scale* are properly represented by Total Sales as reported in the firm's financial statements.

Hypothesis 1:

H0: *Economies of Scale* are not significant

3.4.2 - Low Costs Achieved

Porter (1985) argued that low cost is one source of competitive advantage a firm may possess. The author presented the following 10 cost drivers as the main determinant of cost performance: economies of scale; learning and spillovers; the pattern of capacity utilization; linkages; interrelationships; integration, timing; discretionary policies; location; and institutional factors. The mentioned cost factors can be more or less under a firm's control.

Day and Wensley (1988) identified lower relative costs as a positional advantage. It occurs when a firm is able to perform most activities at a lower cost than competitors. They have used the example of Nucor, which by using scrap metal instead of iron ore achieved cost advantage.

If used efficiently, low cost position, allows a firm to earn above average returns in spite of strong competitive forces such as: rivalry within the industry, bargaining power of buyers, bargaining power of suppliers, potential entrants, and product substitutes (Ireland et al, 2007). We will use Gross Margin as proxy for low costs achieved, since it is a measure of a firm's manufacturing and distribution process. McConaugby, Matthews and Fialko (2001) used Gross Margin as proxy for operational profitability.

Assumption 2: *Low Costs Achieved* is properly represented by Gross Margin as reported in the firm's financial statements.
Hypothesis 2:
H0: *Low Costs Achieved* are not significant

3.4.3 - Financial Strength and Financial Skills of an Organization

The basic financing of any merchant operation is vital to its survival. In the absence of working capital the operation would be financially struggled and with no initial capital to initiate the venture the company would never exist in the first hand. Thus every firm needs to possess financial basic skills.

Ireland et al (2007) went further in detail and enhanced two main financial resources: the firm's borrowing capacity, and the firm's ability to generate internal funds. The authors also mention financial ability as a resource vital to achieve competitive advantage either when the industry is capital intensive or when pursuing growth opportunities.

Efficient Market Hypothesis, Fama (1970), has been used to defend the idea that every good business will find financial back up in the capital market. However, EMH has been criticized in the last years and several anomalies have been spotted (Myers and Brealey, 2003). Even if the EMH holds, imperfections arise that will disturb the optimal capital allocation. Barney (1986) argues that when few firms have the financial backing to acquire strategic factors, since there are no perfect competition dynamics, then there will be opportunities to achieve above average returns. Thus the corporation's financial strength serves has source of competitive advantage. Capital markets will prefer to apply its capital in established firms, avoiding the uncertainty of newcomers, Barney (1986). This way the market will rely on the reputation of established corporations with a solid balance sheet. The ultimate case would be the one where the capital markets would apply resources in a newcomer but at one risk premium rate that would put the newcomer at a financial disadvantage.

Myers and Brealey (2003), also mention the ability to allocate financial resources in the assets with higher expected value is a source of above average returns. Thompson (1992) mentioned that long-term debt to total equity ratio is a measure of financial strength widely used in the Steel industry.

Assumption 3: *Long-term debt to total equity* ratio represents properly the Financial Strength and Financial Skills of an organization.
Hypothesis 3:
H0: *Financial Strength and Financial Skills of an organization* are not significant

3.4.4 - Innovation

Innovation is “the acceptance and implementation of new ideas, processes, products and services.” (Thompson, 1965, p.1).
Drucker (1998 p.149) states that innovation “(…) is the means by which the entrepreneur either creates wealth-producing resources or endows existing resources with enhanced potential for creating wealth.”
Hurley & Hult (1998) further divide innovation in two different stages: i) *Innovativeness*: which is the openness of a company’s culture toward innovation, and ii) *capacity to innovate*: that is the ability of a given organization to implement new ideas in its processes or products.
Many organizational theorists defend that innovation has sources inside and outside the company. Drucker (1998) highlights as main internal sources of innovations: unexpected occurrences, incongruities, process needs, industry and market changes, and as main external sources of innovation: demographic changes, changes in perception and new knowledge.
In general, organizations that possess capacity to innovate are able to develop competitive advantages and generate higher levels of performance. Reichstein and Salter (2006) used Capex-to-Sales ratio as proxy for innovation.

Assumption 4: *Innovation* is properly represented by Capex-to-Sales ratio as reported in the firm’s Financial Reports
Hypothesis 4:
H0: *Innovation* is not significant

The following table shows the proxies used for each CA and its expected relation with stock returns.

**Table 1 - Expected CA impact on stock returns**

This table presents the proxies of the Competitive Advantages and its expected effect on stock returns

| Competitive Advantage | Proxy | Expected Effect on Stock Returns |
|---|---|---|
| Economies of Scale | Total Sales | + |
| Low Costs Achieved | Gross Margin | + |
| Financial Strength and Financial Skills | Long Term Debt-to-Total Equity ratio | - |
| Innovation | Capex-to-Sales ratio | + |

# 4 - The Model

### *4.1 - Data*

We used all firms in Bloomberg World Steel Index, which was taken from the Bloomberg database. All companies which do not have complete data for the period were excluded, in order to have a balanced panel data in which every company has one observation for each year. This will allow us to follow the evolution of the performance of the companies during the entire period, and avoid the problems associated with unbalanced panels. This resulted in the formation of a database of 40 companies (Annex 1) for 7 years, from 2004 to 2010. We chose this period range because the Bloomberg World Steel Index does not have any historical record before these dates. In the date range we have 4 years of economic growth and 3 years of economic recession, we think that this data covers a wide range of scenarios, good and bad, which adds value to the study. Actually, this will allow us to test the impact of the subprime crisis. Also the theory in panel data suggests that 7 years is enough for the study to be credible. We used gretl 1.9.5cvs software to do the statistical analysis. The data was organized as panel data. We will use the models suitable to this kind of data, such as the pooled OLS, the GLS with fixed effects and the GLS with random effects.

### *4.2 – Model*

The variables:

$R_{pt} - R_{ft}$ is the dependent variable, and corresponds to the difference between the stock returns of company *p* and the *EURIBOR*[1] 12 months interest rate for year *t*. In this case we used the returns, and risk free returns for each year starting in the 1st of April of each year. We justify this action with the fact that all the companies usually take the first three months of the year to present its annual results, therefore we have to cover the gap between the end of the fiscal year, and the presentation of the information to the public. Fama and French (1992) used a similar procedure for their work, but in their case they used 6 months. We think that the companies present in our sample are in position to present their financial information to the public until the end of the 1st quarter, additionally we think that if we were to follow Fama-French period of 6 months, we would be creating a bias because most of the companies observed are prominent companies that disclose financial information quarterly. So we would be capturing returns that would be affected by the information of the 1st quarter of the following year, this way undermining our results.

$R_{mt} - R_{ft}$ is the difference between the market returns and the risk free returns for year *t*, starting in the 31st of March. The benchmark used is the Bloomberg Europe 500 Steel Industry.

Hypothesis 5:

H0: We accept that $R_{mt} - R_{ft}$ is not statistically different from zero

H1: We do not reject that $R_{mt} - R_{ft}$ is statistically different from zero

$LN\_SIZE_{pt}$ is the natural logarithm of the Market Capitalization of the company *p* in the year *t*. We use the natural log because we think that best represents the behaviour of the variable.

[1] The use of EURIBOR as proxy for the risk free rate of return is not new, it has been used before in some works as in Vaihekoski (2009). We should also add that the 12 months maturity was chosen because we are working with yearly returns.

Hypothesis 6:

H0: We accept that $LN\_SIZE_{pt}$ is not statistically different from zero

H1: We do not reject that $LN\_SIZE_{pt}$ is statistically different from zero

$BEME_{pt}$ is the Book Equity to Market Equity ratio of company $p$ in the year $t$ .

Hypothesis 7:

H0: We accept that $BEME_{pt}$ is not statistically different from zero

H1: We do not reject that $BEME_{pt}$ is statistically different from zero

$GROSS_{pt}$ is the Gross Margin ratio of company $p$ in the year $t$. With this variable we expect to control for the CA Low Costs Achieved.

Hypothesis 8:

H0: We accept that $GROSS_{pt}$ is not statistically different from zero

H1: We do not reject that $GROSS_{pt}$ is statistically different from zero

$dGROSS_{pt}$ is the first difference of $GROSS_{pt}$ of company $p$ in the year $t$. With this variable we want to control for improvements in Low Costs Achieved.

Hypothesis 9:

H0: We accept that $dGROSS_{pt}$ is not statistically different from zero

H1: We do not reject that $dGROSS_{pt}$ is statistically different from zero

$LTDTTE_{pt}$ is the Long Term Debt to Total Equity of company $p$ in the year $t$. With this variable we want to control for Financial Strength and Financial Skills.

Hypothesis 10:

H0: We accept that $LTDTTE_{pt}$ is not statistically different from zero

H1: We do not reject that $LTDTTE_{pt}$ is statistically different from zero

$sq\_LTDTTE_{pt}$ is the square of ratio of company *p* in the year *t*. We used this setup because, theoretically, as the LTDTTE ratio increases it will have a positive effect in the returns, but as the LTDTTE increases to large levels, then it will start to have a marginal negative impact in the company.

Hypothesis 11:

H0: We accept that $sq\_LTDTTE_{pt}$ is not statistically different from zero

H1: We do not reject that $sq\_LTDTTE_{pt}$ is statistically different from zero

$LN\_SALES_{pt}$ is the natural logarithm of the sales of company *p* in the year *t*. This variable represents the impact of Economies of Scale in the returns of the stocks returns. Again we used the natural log since it makes theoretical sense and it best represents the behaviour of the variable.

Hypothesis 11:

H0: We accept that $LN\_SALES_{pt}$ is not statistically different from zero

H1: We do not reject that $LN\_SALES_{pt}$ is statistically different from zero

$LN\_CAPEXSAL_{pt}$ is the ratio of capex to sales ratio of company *p* in the year *t*. With this variable we want to capture the impact of innovation on stock returns. Our interpretation is that the natural log is the better way to represent the impact of the variable because the in some cases the *Capexsal* ratio has a disproportioned size due to the impact of sales collapse during the crisis, and not because of the reinforcement of the investment in innovation. This way we decided to use the logarithm to smooth this effect on the variable.

Hypothesis 12:

H0: We accept that $LN\_CAPEXSAL_{pt}$ is not statistically different from zero

H1: We do not reject that $LN\_CAPEXSAL_{pt}$ is statistically different from zero

$CRISIS$ is a dummy variable that controls for the effect of the Subprime crisis. $CRISIS$ is 1 in the years of 2008, 2009 and 2010, and 0 otherwise.

Hypothesis 13:

H0: We accept that $CRISIS$ is not statistically different from zero

H1: We do not reject that $CRISIS$ is statistically different from zero

The variables mentioned will be studied in the following model:

$$R_{pt} - R_{ft} = C + \beta_1.(R_{mt} - R_{ft}) + \beta_2.BEME_{pt} + \beta_3.LN\_SIZE + \beta_4.GROSS_{pt} + \beta_5.dGROSS_{pt} + \beta_6.LN\_SALES_{pt} + \beta_7.LTDTTE_{pt} + \beta_8.sq\_LTDTTE_{pt} + \beta_9.LN\_CAPEXSAL_{pt} + \gamma_1 CRISIS$$

# 5 – Results

From the data available we obtained the following descriptive statistics:

**Table 2 - Summary Statistics**

This tables present the results obtained for the descriptive statistics for all the variables studied. We included the results for the mean, median, minimum, maximum, standard deviation, coefficient of variation, skewness, and kurtosis. We excluded the variable *CRISIS* because due to the fact that it is a dummy variable and its results are meaningless.

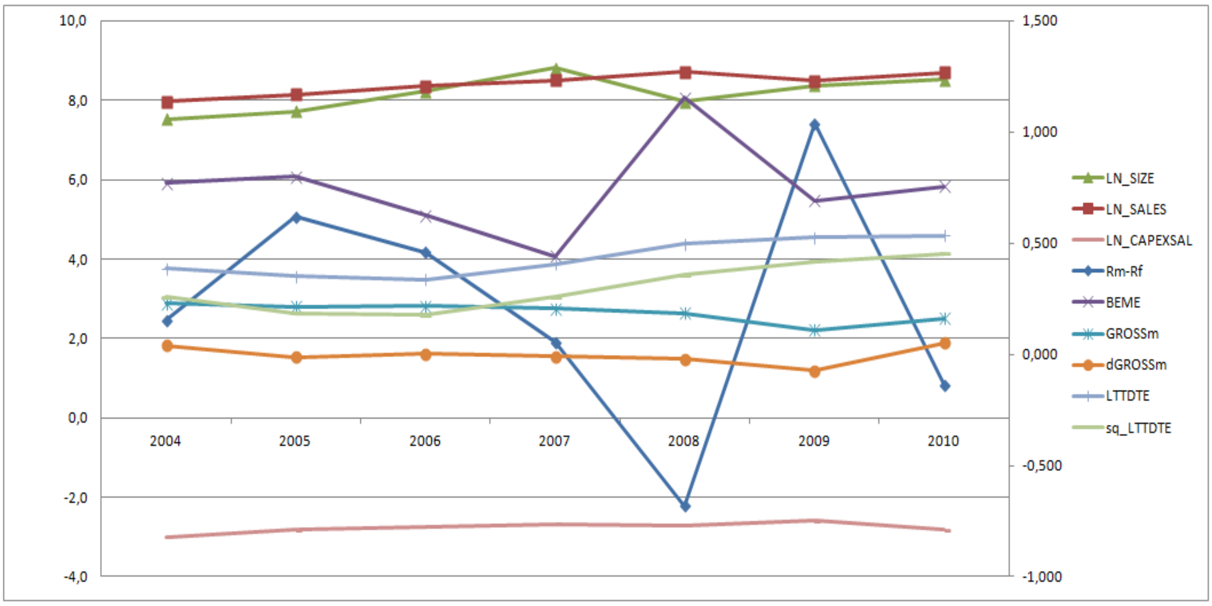
| Variable | Mean | Median | Minimum | Maximum |
|---|---|---|---|---|
| **BEMEpt** | 0.747667 | 0.685433 | 0.000407399 | 2.50536 |
| **LTDTTEpt** | 0.433367 | 0.364001 | 1.00000e-006 | 2.40081 |
| **GROSSpt** | 0.188514 | 0.175826 | -0.109522 | 0.569769 |
| **dGROSSpt** | -0.00395138 | -0.00561300 | -0.253750 | 0.313895 |
| **Rpt_Rft** | 0.254708 | 0.184450 | -0.863942 | 2.89446 |
| **Rmt_Rft** | 0.214975 | 0.153226 | -0.680797 | 1.03887 |
| **LN_SALESpt** | 8.40904 | 8.37225 | 2.26043 | 11.3548 |
| **LN_SIZEpt** | 8.16410 | 8.12756 | 4.14443 | 11.2302 |
| **sq_LTDTTEpt** | 0.300624 | 0.132497 | 1.00000e-012 | 5.76391 |
| **LN_CAPEXSALpt** | -2.76225 | -2.75838 | -5.50731 | -0.795588 |

| Variable | Std. Dev. | Coef. Variation | Skewness | Ex. kurtosis |
|---|---|---|---|---|
| **BEMEpt** | 0.415806 | 0.556138 | 1.00380 | 1.79365 |
| **LTDTTEpt** | 0.336483 | 0.776437 | 1.53671 | 4.47123 |
| **GROSSpt** | 0.103470 | 0.548868 | 0.963885 | 1.83665 |
| **dGROSSpt** | 0.0682224 | 17.2655 | 0.0879567 | 2.64345 |
| **Rpt_Rft** | 0.642641 | 2.52305 | 0.897532 | 1.05866 |
| **Rmt_Rft** | 0.515928 | 2.39995 | -0.133349 | -0.663195 |
| **LN_SALESpt** | 1.21076 | 0.143984 | -1.18657 | 5.02857 |
| **LN_SIZEpt** | 1.10852 | 0.135780 | -0.190254 | 0.405717 |
| **sq_LTDTTEpt** | 0.518667 | 1.72530 | 5.48641 | 46.0447 |
| **LN_CAPEXSALpt** | 0.732716 | 0.265261 | -0.327673 | 0.691072 |

The analysis of the main statistics provides us a good picture of the data available. The results show that the sample chosen provides a wide range of observations that will offer robustness to the results obtained. For each variable the mean assumes expected standard values. For example *BEMEpt* has a 0.75 mean, *GROSSpt* has a 0.18 mean and *LTDTTEpt* has 0.43 mean. This values are common for the steel industry. On the other side the minimum and maximum values also cover a wide range of possibilities. *LTDTTEpt* varies from 0 to 2.40, which includes underleveraged and overleveraged companies in the sample. The same is valid for the other variables, which means, as we said before, that we have a good range of observations.

**Figure 1 - Dependent Variables**

This graph represents the behaviour of the dependent variables trough the period from 2004 to 2010. The left axis represents the scale for the *LN_SIZE*, *LN_SALES* and *LN_CAPEXSAL*. The right axis represents the scale for: *Rm_Rf*, *BEME*, *GROSSm*, *dGROSSm*, *LTTDTE*, and *sq_LTTDTE*.




The above figure describes the behaviour of the average of the dependant and independent variables during the period studied. The analysis of the graph does not reveal the presence of a defined trend. Also each variable reveals different behaviours, which suggests that the regression should not be affected by spurious relations between the dependent and independent variables.

We begin by constructing a pooled OLS with robust standard errors that fit the model described in the previous paragraphs.

**Table 3 - Model 1: Pooled OLS**

This tables present the results for a Pooled OLS model with robust standard errors using 280 observations, covering a period of 7 years, from 2004 to 2010. The data was organized as panel data. We included results for the coefficients, standard errors, t-ratios, and p-values. We added a significance column which contains a * if the variable is significant at 10% level, ** if the variable is significant at a 5% level, and *** if the variable is significant at 1% level. We also add an extra table to include the usual fitness tests.

Model 1: Pooled OLS, using 280 observations
Included 40 cross-sectional units
Time-series length = 7
Dependent variable: Rpt_Rft
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | *Significance* |
|---|---|---|---|---|---|
| **Const** | 0.272982 | 0.291178 | 0.9375 | 0.34934 | |
| **Rmt_Rft** | 0.712783 | 0.0685166 | 10.4031 | <0.00001 | *** |
| **BEMEpt** | -0.237037 | 0.0751349 | -3.1548 | 0.00179 | *** |
| **LN_SIZEpt** | 0.0558484 | 0.0667907 | 0.8362 | 0.40380 | |
| **GROSSpt** | -0.0348769 | 0.279846 | -0.1246 | 0.90091 | |
| **dGROSSpt** | 1.09242 | 0.601212 | 1.8170 | 0.07032 | * |
| **LTDTTEpt** | 0.289007 | 0.142789 | 2.0240 | 0.04396 | ** |
| **sq_LTDTTEpt** | -0.18499 | 0.0669499 | -2.7631 | 0.00612 | *** |
| **LN_CAPEXSALpt** | -0.0434963 | 0.0394642 | -1.1022 | 0.27137 | |
| **LN_SALESpt** | -0.0714164 | 0.0551825 | -1.2942 | 0.19671 | |
| **CRISIS** | -0.0666823 | 0.0594241 | -1.1221 | 0.26280 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.254708 | S.D. dependent var | 0.642641 |
| Sum squared resid | 65.06652 | S.E. of regression | 0.491816 |
| R-squared | 0.435301 | Adjusted R-squared | 0.414309 |
| F(10, 269) | 20.73600 | P-value(F) | 2.28e-28 |
| Log-likelihood | -192.9897 | Akaike criterion | 407.9793 |
| Schwarz criterion | 447.9620 | Hannan-Quinn | 424.0164 |
| rho | -0.087654 | Durbin-Watson | 1.950140 |

The model suggests that only $R_{mt} - R_{ft}$, $BEME_{pt}$, $dGROSS_{pt}$, $LTDTTE_{pt}$ and $sq\_LTDTTE_{pt}$ are statistically significant variables.

From the results obtained we can conclude that as expected the market $\beta$ is positively correlated with Stock returns. High *BE/ME* ratios have a negative impact on returns, and in this case *SIZE* has no statistical significant impact on stock returns. The results also allow us to conclude that improvements in *Gross Margin* have a positive effect on stock returns, which reinforces our view that an improvement in Low Costs Achieved CA is important in this industry. The *LTDTTE* ratio also has a significant impact on returns and, as we suspected, an increment in long term debt is positive on returns, but as debt starts to accumulate this effect starts to be marginally negative.

This model has a 43.53% R-squared, which is high.

However after performing the Breusch-Pagan test, detailed in Annex 2, with a 0.03 p-value, reveals that a GLS model with random effects is preferable to the pooled OLS.

This way we computed a GLS with random effects model, which obtained the following results:

**Table 4 - Model 2: Random Effects GLS**

This table presents the results for a random effects GLS model using 280 observations and covering a period of 7 years, from 2004 to 2010. The data was organized as panel data. We included results for the coefficients, standard errors, t-ratios, and p-values. We added a significance column which contains a * if the variable is significant at 10% level, ** if the variable is significant at a 5% level, and *** if the variable is significant at 1% level. We also add an extra table to include the usual fitness tests. The present model is preferable to the model in table 3 as suggested in the tests in annex.

Model 2: Random-effects (GLS), using 280 observations
Included 40 cross-sectional units
Time-series length = 7
Dependent variable: Rpt_Rft

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | *Significance* |
|---|---|---|---|---|---|
| **Const** | 0.272982 | 0.328581 | 0.8308 | 0.40683 | |
| **Rmt_Rft** | 0.712783 | 0.0651397 | 10.9424 | <0.00001 | *** |
| **BEMEpt** | -0.237037 | 0.10058 | -2.3567 | 0.01916 | ** |
| **LN_SIZEpt** | 0.0558484 | 0.0615369 | 0.9076 | 0.36492 | |
| **GROSSpt** | -0.0348769 | 0.371981 | -0.0938 | 0.92537 | |
| **dGROSSpt** | 1.09242 | 0.499181 | 2.1884 | 0.02950 | ** |
| **LTDTTEpt** | 0.289007 | 0.217886 | 1.3264 | 0.18583 | |
| **sq_LTDTTEpt** | -0.18499 | 0.136672 | -1.3535 | 0.17702 | |
| **LN_CAPEXSALpt** | -0.0434963 | 0.0443589 | -0.9806 | 0.32769 | |
| **LN_SALESpt** | -0.0714164 | 0.0566653 | -1.2603 | 0.20865 | |
| **CRISIS** | -0.0666823 | 0.0695061 | -0.9594 | 0.33823 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.254708 | S.D. dependent var | 0.642641 |
| Sum squared resid | 65.06652 | S.E. of regression | 0.490904 |
| Log-likelihood | -192.9897 | Akaike criterion | 407.9793 |
| Schwarz criterion | 447.9620 | Hannan-Quinn | 424.0164 |

After performing the Hausman test (Annex 3), with a p-value of 0.135, we do not reject the hypothesis that the GLS is consistent and therefore this model is preferable to the pooled OLS shown before.

The results obtained from this model go in the same direction as the pooled OLS, with the exception of the variables $LTDTTE_{pt}$ and $sq\_LTDTTE_{pt}$ that are no longer significant.

The variable $BEME_{pt}$ has a negative coefficient. This indicate that value or distressed stocks have poor performance in this industry. This might happen as a consequence of persistent weak earnings that are characteristic of companies with high *BE/ME* ratios (Fama and French, 1993). The market may interpret historical bad earnings has management inability to improve the company's competitive position. The market $\beta$ (the coefficient of $R_{mt} - R_{ft}$) has a positive impact on stock returns as was expected in CAPM theory. The first difference of gross margin, $dGROSS_{pt}$, has a positive impact on returns, however $GROSS_{pt}$ is not statistically relevant. Our interpretation is that investors already discounted the ability of a company to achieve a determined $GROSS_{pt}$, what the market wants to know is the capacity to improve the efficiency of the company. Therefore the market, in average, will reward any improvement, or punish any fallback in the operations efficiency without caring about the starting point.

Additionally we must note that in neither model we found the variable *CRISIS* relevant. However, we think that this happens because the $R_{mt} - R_{ft}$ already captures the negative effects of the crisis in the market. So although the crisis appears to have no impact on our model it would be interesting to construct two models for the same observations, one before and other during the Subprime crisis.

We started by constructing a model restricted to *CRISIS* = 0 (before the subprime crisis) and we have followed the same procedure as before. We started by constructing a pooled OLS with Robust Standard Errors (Annex 4), and then after performing the Hausman test which resulted in a 0.002 p-value (Annex 5), we decided to that a GLS with Fixed Effects was a preferable model:

**Table 5 - Model 3: Fixed-Effects GLS Before Crisis**

This table presents the results for a fixed-effects GLS model using 160 observations and covering a period of 4 years, from 2004 to 2007. The data was organized as panel data. We included results for the coefficients, standard errors, t-ratios, and p-values. We added a significance column which contains a * if the variable is significant at 10% level, ** if the variable is significant at a 5% level, and *** if the variable is significant at 1% level. We also add an extra table to include the usual fitness tests. We chose to construct this model to be able to extract the impact of the CA in the stock returns before the subprime crisis of 2008.

Model 3: Fixed-effects, using 160 observations
Included 40 cross-sectional units
Time-series length = 4
Dependent variable: Rpt_Rft
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | *Significance* |
|---|---|---|---|---|---|
| **Const** | -2.78514 | 1.8335 | -1.5190 | 0.13160 | |
| **Rmt_Rft** | 0.881271 | 0.209493 | 4.2067 | 0.00005 | *** |
| **BEMEpt** | -1.0802 | 0.295165 | -3.6597 | 0.00039 | *** |
| **LN_SIZEpt** | -0.296697 | 0.193251 | -1.5353 | 0.12756 | |
| **GROSSpt** | -1.44819 | 1.13689 | -1.2738 | 0.20539 | |
| **dGROSSpt** | 4.62935 | 1.06773 | 4.3357 | 0.00003 | *** |
| **LTDTTEpt** | 0.752235 | 0.727596 | 1.0339 | 0.30345 | |
| **sq_LTDTTEpt** | -0.446638 | 0.523684 | -0.8529 | 0.39556 | |
| **LN_CAPEXSALpt** | -0.143176 | 0.106756 | -1.3412 | 0.18261 | |
| **LN_SALESpt** | 0.69351 | 0.343325 | 2.0200 | 0.04579 | ** |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.393563 | S.D. dependent var | 0.570554 |
| Sum squared resid | 30.28861 | S.E. of regression | 0.522370 |
| R-squared | 0.414821 | Adjusted R-squared | 0.161770 |
| F(48, 111) | 1.639281 | P-value(F) | 0.017565 |
| Log-likelihood | -93.87799 | Akaike criterion | 285.7560 |
| Schwarz criterion | 436.4395 | Hannan-Quinn | 346.9433 |
| rho | -0.236167 | Durbin-Watson | 1.968268 |

This regression provides interesting results. First the signal of the significant variables stays the same as before, but now the natural log of Sales, $LN\_SALES_{pt}$, is also significant. The fact that Sales have a positive impact on stock returns suggests the presence of Economies of Scale as a CA, before the crisis. This makes theoretical sense. As we said before the Steel Industry has enormous fixed costs, which causes the Steel Mills to operate as near as possible to its total capacity. So before the crisis started there was a level of demand that allowed the mills to pursue Economies of Scale in order to obtain CA. This way, as we observe in the model, the companies with higher level of sales also seem to have higher than average returns. However the crisis brought lower demand, but at the same time the fixed costs remained the same, which usually means losses to the Steel producers. Therefore, during a crisis, a Steel producer is not able to pursue economies of scale. The mills usually change the focus to streamlining the operations.

We should also add that in this regression the coefficient of $GROSS_{pt}$ is even bigger, which suggests that the market puts even larger pressure on the ability of a company to be efficient.

Now we should compare these results with a regression during the crisis, *CRISIS* = 1.

Again we started with a pooled OLS with robust standard errors, which this time, after reviewing the tests, in Annex 6, the pooled OLS is the preferable model. The joint significance test yielded a p-value of 0.68, which means that the pooled OLS should not be rejected in favour of a GLS with fixed effects and the Breusch-Pagan test yielded a p-value of 0.26, which means that we should not reject the pooled OLS in favour of a GLS with random effects.

**Table 6 - Model 4: Pooled OLS During Crisis**

This table presents the results for a pooled OLS model with robust standard errors using 120 observations and covering a period of 3 years, from 2008 to 2010. The data was organized as panel data. We included results for the coefficients, standard errors, t-ratios, and p-values. We added a significance column which contains a * if the variable is significant at 10% level, ** if the variable is significant at a 5% level, and *** if the variable is significant at 1% level. We also add an extra table to include the usual fitness tests. We chose to construct this model to be able to extract the impact of the CA in the stock returns during the subprime crisis that started in 2008.

Model 4: Pooled OLS, using 120 observations
Included 40 cross-sectional units
Time-series length = 3
Dependent variable: Rpt_Rft
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | *Significance* |
|---|---|---|---|---|---|
| **Const** | 0.0582618 | 0.24575 | 0.2371 | 0.81304 | |
| **Rmt_Rft** | 0.69527 | 0.0822501 | 8.4531 | <0.00001 | *** |
| **BEMEpt** | -0.113711 | 0.0846635 | -1.3431 | 0.18201 | |
| **LN_SIZEpt** | 0.054626 | 0.0878728 | 0.6216 | 0.53546 | |
| **GROSSpt** | 0.592527 | 0.497085 | 1.1920 | 0.23582 | |
| **dGROSSpt** | -0.88703 | 0.620993 | -1.4284 | 0.15601 | |
| **LN_SALESpt** | -0.0701793 | 0.0882836 | -0.7949 | 0.42837 | |
| **LTDTTEpt** | 0.329872 | 0.171792 | 1.9202 | 0.05742 | * |
| **sq_LTDTTEpt** | -0.20761 | 0.0837485 | -2.4790 | 0.01469 | ** |
| **LN_CAPEXSALpt** | -0.00843044 | 0.0476717 | -0.1768 | 0.85996 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.069568 | S.D. dependent var | 0.687620 |
| Sum squared resid | 19.54994 | S.E. of regression | 0.421577 |
| R-squared | 0.652542 | Adjusted R-squared | 0.624114 |
| F(9, 110) | 22.95393 | P-value(F) | 1.59e-21 |
| Log-likelihood | -61.40146 | Akaike criterion | 142.8029 |
| Schwarz criterion | 170.6778 | Hannan-Quinn | 154.1231 |
| rho | -0.119647 | Durbin-Watson | 2.005711 |

The set of results provide us again with interesting results. The variables *dGROSSpt* and *LN_SALESpt* are no longer significant. On the other hand, the two proxies for Financial Strenght and Financial Skills, *LTDTTEpt* and *sq_LTDTTEpt* are now relevant. We can speculate that during the crisis the investors are less worried with the operational excellence of a steel mill, and more worried about its chance of survival, than in bad times. During a crisis the survival of a Steel producer is more dependent on the ability to manage debt. This means that the financial ability and strength is a major CA in the Steel industry during an economic crisis.

We think the results are clarifying in relation to the importance of CAs to stock returns. Not all of the CAs we tested were considered relevant, but we have seen that the importance of the competitive advantages also depends on the external competitive scenario where the company operates.

## 6 – Limitations and Problems

In this section we would like to emphasize the limitations in this work.

First of all we must alert to the fact that every limitation known to the models used in this work are also present here.

In every work the foundations of the conclusions are based on assumptions. If the assumptions hold, the conclusions obtained are good, if not, then the conclusions will be undermined. We are not an exception to this rule. In section 3 we defined assumptions relative to the variables to be used as proxies for CAs. We have justified our choices with robust arguments, however there is always the possibility of our proxies not being the most adequate to the task.

The information disclosed by public companies is also, in many cases, insufficient to extract quantifiable variables that are useful to create proxies for CAs. Accounting measures and other loopholes might constitute too much noise for some proxies to be useful.

The lack of literature and models already testing the relation between CAs and stock returns is also a limitation since we had to create our own framework, and it has not been tested before in the same context.

In synthesis our work has some degree of limitations, but nevertheless we incurred in a big effort to fundament our work with the best literature available and statistical models available.

# 7 – Conclusions and Insights for Future Research

In the light of the results obtained we can conclude that Competitive Advantages (CAs) cannot be rejected as sources of excess stock returns. The main model, including pre and after crisis data, revealed that an improvement in Low Costs Achieved do have a relevant impact on the returns of the companies studied, after controlling for Fama-French variables. This is in accordance with the strategy literature, Porter (1985), which states that CAs should lead to higher than average profits, and with valuation theory, Williams (1938), which states that above average returns profits should lead to above average investment returns.

In the case of the pre-crisis model, the results indicate again that an improvement of Low Costs Achieved cannot be rejected as source of excess returns. This model also indicates that Economies of Scale are source of excess returns. We can conclude that under stability the market simply rewards improvements in operational efficiency and scale (which is related with operational efficiency). This is a coherent result since Steel mills operations have to absorb the huge fixed costs incurred by the mills (Thompson, 1992). Better than average operations efficiency will result in better than average returns.

However the post-crisis model suggests that only Financial Skills and Financial Strength CA is source of excess returns. This means that in uncertainty contexts, the market does not care about operational efficiency anymore, focusing on closely monitoring the financial health of the company. With the economic down cycle, the market recognizes that the Steel mills will no longer be efficient. So the investors prefer to focus on the company's ability to survive during bad times.

This findings brings a new light to the process of assessing perspectives for any given company. If the security analyst selects the appropriate CAs useful in a given industry, and is able to do a quantitative study, then he might, with more ease, find the companies that will have more probability and perform better. This might be useful in the choice of assumptions for the valuation matrix, conferring added robustness to the valuation.

This study should be made for other industries, and for other CAs, in order to provide more information. Works in other sectors might be done to help sustaining or to refute our theory. Also studies about the robustness of the proxies used might be done to help sustain or refute the theory presented in this work.

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# Annex 1 – Companies Studied

The 40 companies included in the data were the following

Allegheny Technologies Inc
Angang Steel Co Ltd
ArcelorMittal
Baoshan Iron & Steel Co Ltd
Bengang Steel Plates Co
CAP SA
China Steel Corp
Cia Siderurgica Nacional SA
Citic Pacific Ltd
Cliffs Natural Resources Inc
Daido Steel Co Ltd
Dongkuk Steel Mill Co Ltd
Eregli Demir ve Celik Fabrikalari TAS
Gansu Jiu Steel Group Hongxing Iron & St
Gerdau SA
Hebei Iron & Steel Co Ltd
Hitachi Metals Ltd
Hyundai Steel Co
Kobe Steel Ltd
Maanshan Iron & Steel
Metalurgica Gerdau SA
Nanjing Iron & Steel Co Ltd
Nippon Steel Corp
Nisshin Steel Co Ltd
Nucor Corp
Outokumpu OYJ
Pangang Group Steel Vanadium & Titanium
POSCO
Reliance Steel & Aluminum Co
Shandong Jinling Mining Co Ltd
Siderar SAIC
SSAB AB
Steel Dynamics Inc
Sumitomo Metal Industries Ltd
ThyssenKrupp AG
United States Steel Corp
Usinas Siderurgicas de Minas Gerais SA
Voestalpine AG
Wuhan Iron & Steel Co Ltd
Yamato Kogyo Co Ltd

The 71 initial companies were the following:

Acerinox SA
Allegheny Technologies Inc
Angang Steel Co Ltd
ArcelorMittal
Atlas Iron Ltd
Baoshan Iron & Steel Co Ltd
Bengang Steel Plates Co
Bhushan Steel Ltd
BlueScope Steel Ltd
CAP SA
Carpenter Technology Corp
China Steel Corp
Cia Siderurgica Nacional SA
Citic Pacific Ltd
Cliffs Natural Resources Inc
Daido Steel Co Ltd
Dongkuk Steel Mill Co Ltd
Eregli Demir ve Celik Fabrikalari TAS
Ferrexpo PLC
Fortescue Metals Group Ltd
Gansu Jiu Steel Group Hongxing Iron & St
Gerdau SA
Hebei Iron & Steel Co Ltd
Hitachi Metals Ltd
Hunan Valin Steel Co Ltd
Hyundai Steel Co
Inner Mongolian Baotou Steel Union Co Lt
JFE Holdings Inc
Jinan Iron and Steel Co Ltd
Jindal Steel & Power Ltd
JSW Steel Ltd
Kobe Steel Ltd
Krakatau Steel Tbk PT
Kumba Iron Ore Ltd
Liuzhou Iron & Steel Co Ltd
Maanshan Iron & Steel
Magnitogorsk Iron & Steel Works
Mechel
Metalurgica Gerdau SA
MMX Mineracao e Metalicos SA
Mount Gibson Iron Ltd
Nanjing Iron & Steel Co Ltd
Nippon Steel Corp

Nisshin Steel Co Ltd
Novolipetsk Steel OJSC
Nucor Corp
OneSteel Ltd
Outokumpu OYJ
Pangang Group Steel Vanadium & Titanium
POSCO
Rautaruukki OYJ
Reliance Steel & Aluminum Co
Salzgitter AG
Seah Besteel Corp
Severstal OAO
Shandong Jinling Mining Co Ltd
Shanxi Taigang Stainless Steel Co Ltd
Siderar SAIC
SSAB AB
Steel Authority of India Ltd
Steel Dynamics Inc
Sumitomo Metal Industries Ltd
Tata Steel Ltd
ThyssenKrupp AG
Tibet Mineral Development Co
United States Steel Corp
Usinas Siderurgicas de Minas Gerais SA
Voestalpine AG
Vyksa Metallurgical Plant OJSC
Wuhan Iron & Steel Co Ltd
Yamato Kogyo Co Ltd

## Annex 2 – Pooled OLS RSE Tests

```
      Diagnostics: assuming a balanced panel with 40 cross-sectional
units
                         observed over 7 periods

Fixed effects estimator
allows for differing intercepts by cross-sectional unit
slope standard errors in parentheses, p-values in brackets

           const:         1.1315       (0.92377)       [0.22188]
         Rmt_Rft:        0.65556      (0.070948)       [0.00000]
          BEMEpt:       -0.41564       (0.15171)       [0.00663]
      LN_SIZEpt:         0.03706       (0.09533)       [0.69782]
        GROSSpt:        -0.37524       (0.73546)       [0.61039]
       dGROSSpt:         0.90758       (0.58626)       [0.12297]
       LTDTTEpt:         0.31293       (0.32761)       [0.34048]
    sq_LTDTTEpt:        -0.15228       (0.17367)       [0.38148]
  LN_CAPEXSALpt:        -0.09224      (0.065069)       [0.15767]
     LN_SALESpt:        -0.15021       (0.14496)       [0.30118]
          CRISIS:      -0.038859      (0.098242)       [0.69281]

40 group means were subtracted from the data

Residual variance: 58.9658/(280 - 50) = 0.256373
Joint significance of differing group means:
 F(39, 230) = 0.610156 with p-value 0.967028
(A low p-value counts against the null hypothesis that the pooled OLS
model is adequate, in favor of the fixed effects alternative.)


Breusch-Pagan test statistic:
 LM = 4.73706 with p-value = prob(chi-square(1) > 4.73706) = 0.0295194
(A low p-value counts against the null hypothesis that the pooled OLS
model is adequate, in favor of the random effects alternative.)

Variance estimators:
 between = 0.0129579
 within = 0.256373
theta used for quasi-demeaning = 0
```

Random effects estimator

```
           allows for a unit-specific component to the error term
           (standard errors in parentheses, p-values in brackets)

           const:        0.27298       (0.32858)       [0.40683]
         Rmt_Rft:        0.71278       (0.06514)       [0.00000]
          BEMEpt:       -0.23704       (0.10058)       [0.01916]
       LN_SIZEpt:       0.055848      (0.061537)       [0.36492]
         GROSSpt:      -0.034877       (0.37198)       [0.92537]
        dGROSSpt:         1.0924       (0.49918)       [0.02950]
        LTDTTEpt:        0.28901       (0.21789)       [0.18583]
     sq_LTDTTEpt:       -0.18499       (0.13667)       [0.17702]
   LN_CAPEXSALpt:      -0.043496      (0.044359)       [0.32769]
      LN_SALESpt:      -0.071416      (0.056665)       [0.20865]
          CRISIS:      -0.066682      (0.069506)       [0.33823]


Hausman test statistic:
 H = 14.9062 with p-value = prob(chi-square(10) > 14.9062) = 0.13552
(A low p-value counts against the null hypothesis that the random
effects
model is consistent, in favor of the fixed effects model.)
```

# Annex 3 – GLS Random Effects Tests

```
'Within' variance = 0.256373
      'Between' variance = 0.0129579
      theta used for quasi-demeaning = 0

Breusch-Pagan test -
 Null hypothesis: Variance of the unit-specific error = 0
 Asymptotic test statistic: Chi-square(1) = 4.73706
 with p-value = 0.0295194

Hausman test -
 Null hypothesis: GLS estimates are consistent
 Asymptotic test statistic: Chi-square(10) = 14.9062
 with p-value = 0.13552
```

# Annex 4 – Pooled OLS before crisis

Model 12: Pooled OLS, using 160 observations
Included 40 cross-sectional units
Time-series length = 4
Dependent variable: Rpt_Rft
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | 0.39638 | 0.328164 | 1.2079 | 0.22900 | |
| Rmt_Rft | 0.768991 | 0.18555 | 4.1444 | 0.00006 | *** |
| BEMEpt | −0.388556 | 0.150702 | −2.5783 | 0.01089 | ** |
| LN_SIZEpt | 0.0399102 | 0.0808913 | 0.4934 | 0.62247 | |
| GROSSpt | −0.510899 | 0.466911 | −1.0942 | 0.27562 | |
| dGROSSpt | 4.1823 | 0.868486 | 4.8156 | <0.00001 | *** |
| LTDTTEpt | 0.364106 | 0.322649 | 1.1285 | 0.26092 | |
| sq_LTDTTEpt | −0.260265 | 0.270452 | −0.9623 | 0.33743 | |
| LN_CAPEXSALpt | −0.0226288 | 0.0506923 | −0.4464 | 0.65596 | |
| LN_SALESpt | −0.0442464 | 0.0665842 | −0.6645 | 0.50738 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.393563 | S.D. dependent var | 0.570554 |
| Sum squared resid | 37.96578 | S.E. of regression | 0.503096 |
| R-squared | 0.266497 | Adjusted R-squared | 0.222487 |
| F(9, 150) | 6.055346 | P-value(F) | 3.11e-07 |
| Log-likelihood | −111.9511 | Akaike criterion | 243.9022 |
| Schwarz criterion | 274.6539 | Hannan-Quinn | 256.3894 |
| rho | −0.064672 | Durbin-Watson | 1.715865 |

Diagnostics: assuming a balanced panel with 40 cross-sectional units
observed over 4 periods

Fixed effects estimator
allows for differing intercepts by cross-sectional unit
slope standard errors in parentheses, p-values in brackets

| | | | |
|---|---|---|---|
| const: | −2.7851 | (1.6283) | [0.08998] |
| Rmt_Rft: | 0.88127 | (0.21335) | [0.00007] |
| BEMEpt: | −1.0802 | (0.26713) | [0.00010] |
| LN_SIZEpt: | −0.2967 | (0.18501) | [0.11163] |
| GROSSpt: | −1.4482 | (1.2883) | [0.26338] |
| dGROSSpt: | 4.6294 | (1.1037) | [0.00006] |
| LTDTTEpt: | 0.75224 | (0.7915) | [0.34398] |
| sq_LTDTTEpt: | −0.44664 | (0.57136) | [0.43605] |
| LN_CAPEXSALpt: | −0.14318 | (0.10431) | [0.17263] |
| LN_SALESpt: | 0.69351 | (0.31379) | [0.02915] |

40 group means were subtracted from the data

Residual variance: 30.2886/(160 - 49) = 0.27287
Joint significance of differing group means:

```
 F(39, 111) = 0.721407 with p-value 0.87703
(A low p-value counts against the null hypothesis that the pooled OLS
model is adequate, in favor of the fixed effects alternative.)


Breusch-Pagan test statistic:
 LM = 9.11637 with p-value = prob(chi-square(1) > 9.11637) = 0.00253332
(A low p-value counts against the null hypothesis that the pooled OLS
model is adequate, in favor of the random effects alternative.)

Variance estimators:
 between = 0.0197323
 within = 0.27287
theta used for quasi-demeaning = 0

                         Random effects estimator
           allows for a unit-specific component to the error term
           (standard errors in parentheses, p-values in brackets)

           const:         0.39638       (0.43014)       [0.35826]
         Rmt_Rft:         0.76899       (0.19009)       [0.00008]
          BEMEpt:        -0.38856       (0.14722)       [0.00919]
       LN_SIZEpt:         0.03991      (0.092079)       [0.66532]
         GROSSpt:         -0.5109       (0.54272)       [0.34803]
        dGROSSpt:          4.1823       (0.82246)       [0.00000]
        LTDTTEpt:         0.36411       (0.40838)       [0.37404]
     sq_LTDTTEpt:        -0.26027       (0.34016)       [0.44540]
   LN_CAPEXSALpt:       -0.022629      (0.060014)       [0.70666]
      LN_SALESpt:       -0.044246      (0.081008)       [0.58574]

Hausman test statistic:
 H = 25.5643 with p-value = prob(chi-square(9) > 25.5643) = 0.00240642
(A low p-value counts against the null hypothesis that the random
effects model is consistent, in favor of the fixed effects model.)
```

# Annex 5 – GLS Fixed Effects Before Crisis

```
Test for differing group intercepts -
 Null hypothesis: The groups have a common intercept
 Test statistic: F(39, 111) = 0.721407
 with p-value = P(F(39, 111) > 0.721407) = 0.87703


Distribution free Wald test for heteroskedasticity -
 Null hypothesis: the units have a common error variance
 Asymptotic test statistic: Chi-square(40) = 2398.05
 with p-value = 0


Test for normality of residual -
 Null hypothesis: error is normally distributed
 Test statistic: Chi-square(2) = 14.1024
 with p-value = 0.00086637
```

## Annex 6 – OLS Robust SE during the crisis

Model 2: Pooled OLS, using 120 observations
Included 40 cross-sectional units
Time-series length = 3
Dependent variable: Rpt_Rft
Robust (HAC) standard errors

| | *Coefficient* | *Std. Error* | *t-ratio* | *p-value* | |
|---|---|---|---|---|---|
| const | 0.0582618 | 0.24575 | 0.2371 | 0.81304 | |
| Rmt_Rft | 0.69527 | 0.0822501 | 8.4531 | <0.00001 | *** |
| BEMEpt | -0.113711 | 0.0846635 | -1.3431 | 0.18201 | |
| LN_SIZEpt | 0.054626 | 0.0878728 | 0.6216 | 0.53546 | |
| GROSSpt | 0.592527 | 0.497085 | 1.1920 | 0.23582 | |
| dGROSSpt | -0.88703 | 0.620993 | -1.4284 | 0.15601 | |
| LN_SALESpt | -0.0701793 | 0.0882836 | -0.7949 | 0.42837 | |
| LTDTTEpt | 0.329872 | 0.171792 | 1.9202 | 0.05742 | * |
| sq_LTDTTEpt | -0.20761 | 0.0837485 | -2.4790 | 0.01469 | ** |
| LN_CAPEXSALpt | -0.00843044 | 0.0476717 | -0.1768 | 0.85996 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 0.069568 | S.D. dependent var | 0.687620 |
| Sum squared resid | 19.54994 | S.E. of regression | 0.421577 |
| R-squared | 0.652542 | Adjusted R-squared | 0.624114 |
| F(9, 110) | 22.95393 | P-value(F) | 1.59e-21 |
| Log-likelihood | -61.40146 | Akaike criterion | 142.8029 |
| Schwarz criterion | 170.6778 | Hannan-Quinn | 154.1231 |
| rho | -0.119647 | Durbin-Watson | 2.005711 |

```
      Diagnostics: assuming a balanced panel with 40 cross-sectional
units
                         observed over 3 periods

Fixed effects estimator
allows for differing intercepts by cross-sectional unit
slope standard errors in parentheses, p-values in brackets

           const:         1.3636        (2.6634)       [0.61026]
         Rmt_Rft:        0.57689      (0.090615)       [0.00000]
          BEMEpt:       -0.39514       (0.23591)       [0.09835]
       LN_SIZEpt:      0.0059808       (0.14299)       [0.96675]
         GROSSpt:       -0.79274        (1.4899)       [0.59633]
        dGROSSpt:       -0.93671        (0.8364)       [0.26652]
      LN_SALESpt:       -0.11307       (0.26951)       [0.67609]
        LTDTTEpt:        -0.3127       (0.66846)       [0.64137]
     sq_LTDTTEpt:       0.019537       (0.25195)       [0.93841]
   LN_CAPEXSALpt:      -0.071353       (0.12829)       [0.57984]

40 group means were subtracted from the data
```

```
Residual variance: 13.2521/(120 - 49) = 0.18665
Joint significance of differing group means:
 F(39, 71) = 0.865162 with p-value 0.684478
(A low p-value counts against the null hypothesis that the pooled OLS
model is adequate, in favor of the fixed effects alternative.)


Breusch-Pagan test statistic:
 LM = 1.25249 with p-value = prob(chi-square(1) > 1.25249) = 0.263077
(A low p-value counts against the null hypothesis that the pooled OLS
model is adequate, in favor of the random effects alternative.)

Variance estimators:
 between = 0.0400837
 within = 0.18665
theta used for quasi-demeaning = 0

                         Random effects estimator
           allows for a unit-specific component to the error term
           (standard errors in parentheses, p-values in brackets)

           const:       0.058262        (0.48962)        [0.90550]
         Rmt_Rft:        0.69527       (0.068608)        [0.00000]
          BEMEpt:       -0.11371        (0.12465)        [0.36365]
       LN_SIZEpt:       0.054626        (0.07628)        [0.47543]
         GROSSpt:        0.59253        (0.49624)        [0.23503]
        dGROSSpt:       -0.88703        (0.56319)        [0.11812]
      LN_SALESpt:      -0.070179       (0.075719)        [0.35604]
        LTDTTEpt:        0.32987        (0.27148)        [0.22693]
     sq_LTDTTEpt:       -0.20761        (0.14846)        [0.16480]
   LN_CAPEXSALpt:     -0.0084304       (0.060013)        [0.88854]

Hausman test statistic:
 H = 18.1628 with p-value = prob(chi-square(9) > 18.1628) = 0.0333312
(A low p-value counts against the null hypothesis that the random
effects
model is consistent, in favor of the fixed effects model.)
```